Space Weather Forecast

Issued on Saturday, 20 August 2022 at 01:15 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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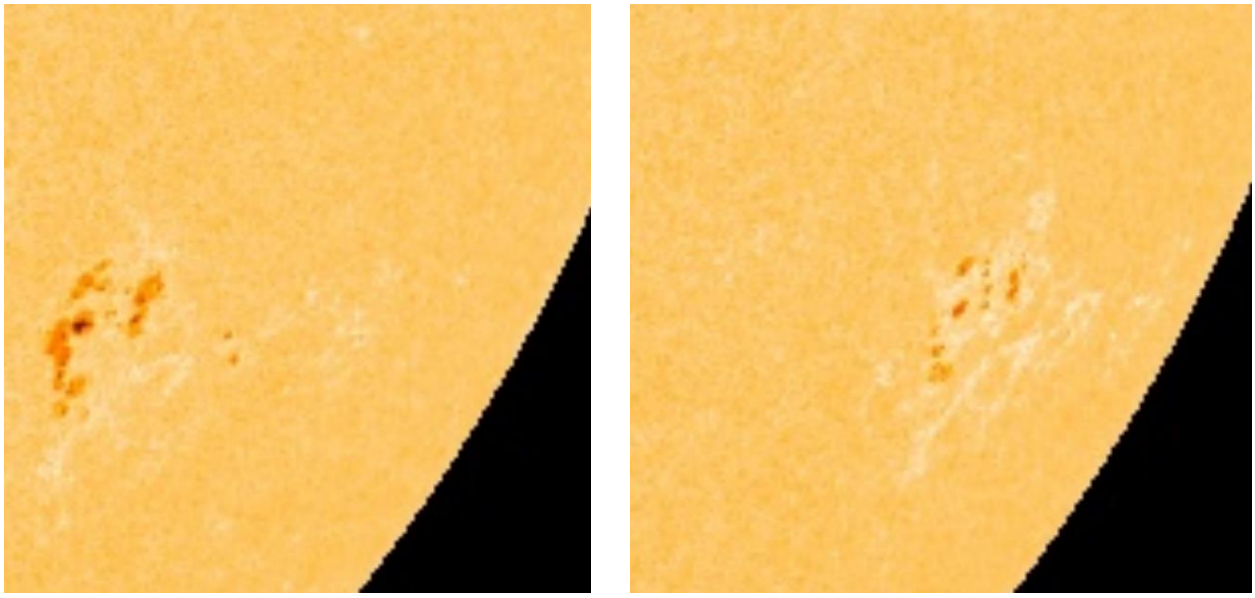
Space Weather Forecast Headline: G1/G2 Minor Geomagnetic Storm possible throughout, but risk peaking to start and end four days. Minor/Moderate Radio Blackouts R1/R2 likely this UTC weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was moderate over the UTC day of Friday 19 August, with X-ray activity showing frequent common-class flares, peaking with a low-end moderate class flare at 19/0444UTC from an active sunspot group in the southwest. This spot was one of up to seven on the Sun by the period's end, with its immediate western neighbour disappearing from view into the UTC evening.

The most active spot on the disc showed a marked change over the 24 hours, with its constituent spots all appearing to shrink, perhaps in part due to its approach to the western solar horizon. Despite any apparent simplification, this group still proved capable of generating significant activity with a middling common-class flare at 19/2031UTC perhaps producing a CME. Any Earth-bound component arising from this event has yet to be determined, however much of the ejecta should be directed below and ahead of the Earth in the track of its orbit from this location.

Figure 1: Visible-light imagery of the most active sunspot region at 18/2220UTC and 19/2220UTC, showing a decaying tendency as well as foreshortening effects near the western solar horizon. Despite this visual decay, the region has produced further flares and CMEs.



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The other six sunspots populating the Earth-facing side were less complex, with many simple magnetic dipoles or else monopoles.

A 'filament' (arc of plasma) visible in the northwest near 10 West on ground-based near infrared imagery gradually disappeared from view through the UTC afternoon of Friday 19 August, however this has yet to manifest on satellite imagery, and it may have failed to leave the immediate solar environment. More definite departures in the period were clustered around the southwest and further flare activity from the most active spot, with up to four events seen leaving this part of the Sun in the 24 hours.

The chances of these above events surviving as well-separated CME arrivals to the radius of the Earth's orbit are considered relatively low, with probable amalgamation and 'cannibalistic' behaviour likely (faster later CMEs swallowing slower earlier ones) as later CMEs emanating from the prolific AR3078 find the interplanetary medium swept out ahead of them to ease their transit. MOSWOC modelling suggests that a glancing CME arrival is possible within the UTC day of Tuesday 23 August, probably concurrent with a fast solar wind. Given the glut of CMEs in the recent past, there is particularly low confidence in geomagnetic forecast detail, and at least a background slight chance of Minor Geomagnetic Storm G1 on all days of the forecast.

Solar Wind / Geomagnetic Activity: The solar wind speed was symptomatic of both a fast wind regime but also a CME arrival at 19/1702UTC. A 42.0nT deflection in the H-component of Hartland magnetometer was subsequently observed around 19/1735UTC, for which a Sudden Impulse Alert was issued.

The solar wind speed rose from elevated to strong with the advent of the CME, having been declining slightly beforehand. The associated number of particles comprising the solar wind rose slightly over the same period. The magnitude of the associated magnetic field fell initially within normal background levels, increasing after the CME arrival into the UTC evening, with the north-south component becoming volatile (co or anti-aligned with Earth's field to lesser or greater effect respectively).

The net result of the above solar wind measures was for provisionally quiet activity in the fast wind, rising to a peak of Minor Geomagnetic Storm in the 18-21UTC interval with the CME.

Energetic Particles / Solar Radiation: No solar radiation storms were observed but the trace was very slightly above its typical Background level, albeit comfortably below S1. The cause of this enhancement is likely to have been flare activity from the most prolific sunspot group although discerning which event is not likely to be possible given the cadence of similar magnitude flares and CMEs from this region.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be moderate over the UTC weekend, with further moderate-class flares likely, primarily from the most active sunspot group. This region should rotate off the Sun into the new working week, with the chances of further such flares falling in tandem. No significant regions are expected over the eastern horizon in the period.

Solar Wind / Geomagnetic Activity: The geomagnetic forecast is low confidence throughout, largely the result of the sheer number of mostly minor CME emissions, with amalgamation of these likely and some cases of glancing incidence possible. These events have been frequent enough that there is a Slight Chance of G1 on all days of the forecast, peaking on day one with a likely G1/G2 Minor/Moderate Geomagnetic Storm (Saturday 20 August) and again on day four, with a Chance of G1/G2 (Tuesday 23 August). These peaks are due to more definite CME arrivals coinciding with peak fast wind activity from successive coronal holes.

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Energetic Particles / Solar Radiation: No solar radiation storms are expected, although there is a slight chance of an S1 or greater event, mainly due to the most active group being near the better-connecting western solar horizon (with Earth).

Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	50	10	10	40
Strong	G3	No	5	1	1	5
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	60	50	25	25
Very Active	R3 to R5 X	No	5	5	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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